TABLE 12

ANALYTICAL RESULTS FROM WIPE SAMPLES – HOUSE 1
BRIDGETON DUST SITE, BRIDGETON, MISSOURI

Sample	Description	U-238	U-234	Th-230	Ra-226	Th-232	Th-228	U-235
BDS-[redacted]-W001	Field blank	< 0.00027	< 0.00039	< 0.00145	< 0.00115	< 0.000355	< 0.0011	< 0.000315
BDS[redacted]-W002	Living room, floor	< 0.00033	< 0.000405	< 0.00145	< 0.000875	< 0.000275	< 0.001	< 0.000265
BDS-[redacted]-W006	Dining room, wall	0.0001	0.00084	< 0.00155	< 0.0012	< 0.000375	< 0.00115	< 0.00029
BDS-[redacted]-W014	Kitchen, wall	< 0.00041	0.000475	< 0.0014	< 0.00145	< 0.000275	< 0.00115	< 0.00037
BDS-[redacted]-W019	Bedroom 2, wall	< 0.000235	< 0.000345	< 0.00145	< 0.0016	< 0.00048	< 0.0012	< 0.0001
BDS-[redacted]-W021	Field blank	< 0.00037	0.00031	< 0.00145	< 0.000885	< 0.00036	< 0.00115	< 0.00044
BDS-[redacted]-W034	Office, west wall	0.000245	< 0.000425	< 0.0014	< 0.00087	< 0.00039	< 0.00105	< 0.000445
BDS-[redacted]-W036	Kitchen entrance, floor	< 0.000385	0.000645	< 0.00145	< 0.00115	< 0.00035	< 0.00105	0.000115
BDS-[redacted]W048	Main entrance, floor	< 0.00038	< 0.00038	< 0.00135	< 0.00125	< 0.00037	< 0.000915	0.000295
BDS-[redacted]W049	Master bedroom, west wall	< 0.0003	< 0.0003	< 0.0014	< 0.0015	< 0.000245	< 0.00088	0.000115
BDS-[redacted]-W052	Laundry, west wall	< 0.00032	0.00057	< 0.0014	< 0.0013	0.00022	< 0.001	< 0.00026
BDS[redacted]-W058	Basement bedroom, west wall	< 0.0005	0.000375	< 0.00135	< 0.00105	< 0.00026	< 0.0011	< 0.00013
BDS-[redacted]-W061	Basement den, floor	< 0.00025	0.000545	< 0.0013	< 0.0013	0.000125	< 0.000765	< 0.00011
BDS-[redacted]-W074	Garage, floor, entrance	< 0.00029	0.000345	< 0.00145	< 0.0012	< 0.000455	< 0.00074	0.000145
Building Preliminary Remediation Goal (BPRG) Corresponding to a Cancer Risk of 1 in 10,000		0.158	0.211	0.188	0.0456	0.0144	1.21	0.202

Notes:

All concentrations in picoCuries per square centimeter (pCi/cm^2)

< Radionuclide not detected (minimum detectable concentration is shown)

Ra Radium
Th Thorium
U Uranium

TABLE 13

ANALYTICAL RESULTS FROM WIPE SAMPLES – HOUSE 2
BRIDGETON DUST SITE, BRIDGETON, MISSOURI

Sample	Description	U-238	U-234	Th-230	Ra-226	Th-232	Th-228	U-235
BDS-[redacted]W001	Field blank	< 0.000255	0.00038	< 0.0016	0.0014	< 0.00049	< 0.0012	< 0.00011
BDS-[redacted]-W003	Kitchen countertop	< 0.0003	0.00064	< 0.0014	< 0.000835	< 0.00027	< 0.0011	0.000115
BDS[redacted]-W004	Kitchen entrance, floor	< 0.000325	0.000575	< 0.0013	< 0.00055	< 0.00034	< 0.0011	< 0.00026
BDS-[redacted]-W005	Garage entrance, floor	< 0.00042	< 0.0003	< 0.00145	< 0.000825	< 0.00035	< 0.00105	< 0.00028
BDS-[redacted]-W006	Back entrance, floor	< 0.000375	0.000345	< 0.0015	< 0.00095	< 0.000285	< 0.00115	< 0.000345
BDS-[redacted]-W007	Main entrance, floor	< 0.000305	< 0.000305	< 0.00145	< 0.000765	< 0.00042	< 0.00095	< 0.000465
BDS-[redacted]-W010	Dining room, floor	< 0.000425	0.00039	< 0.00145	0.00115	0.000155	< 0.00125	0.00015
BDS[redacted]-W016	Living room, north wall	< 0.00023	< 0.000415	< 0.0014	0.0011	< 0.000335	< 0.00105	< 0.000275
BDS-[redacted]W024	Hall linen closet, floor	< 0.00032	< 0.000545	< 0.00145	< 0.000825	0.00045	< 0.00095	< 0.000375
BDS-[redacted]-W034	Master bedroom, floor	< 0.000245	< 0.00036	< 0.00145	< 0.00075	< 0.000345	< 0.0011	< 0.000105
BDS[redacted]-W036	Bedroom 2, north wall	< 0.00009	< 0.00025	< 0.0014	< 0.0009	< 0.000265	< 0.0011	< 0.00037
BDS-[redacted]-W042	Bedroom 1, north wall	< 0.000315	< 0.00041	< 0.00145	< 0.000835	< 0.000465	< 0.00115	< 0.000295
BDS[redacted]-W055	Garage, floor	< 0.00035	< 0.000305	< 0.0015	< 0.000855	< 0.00039	< 0.0012	< 0.000285
BDS-[redacted]-W061	Field blank	< 0.000305	< 0.000435	< 0.0014	< 0.00041	< 0.00041	< 0.00105	< 0.00042
Building Preliminary Remediation Goal (BPRG) Corresponding to a Cancer Risk of 1 in 10,000		0.158	0.211	0.188	0.0456	0.0144	1.21	0.202

Notes:

All concentrations in picoCuries per square centimeter (pCi/cm^2)

< Radionuclide not detected (minimum detectable concentration is shown)

Ra Radium
Th Thorium
U Uranium

6.3 INDOOR BULK DUST SAMPLES

Indoor bulk dust samples were analyzed for uranium and thorium isotopes via alpha spectroscopy, and for radium-226 via detection of radon emanation; results were reported on a per mass basis (i.e., pCi/g) (see Table 14). Each analyzed isotope is naturally occurring, with presence expected in dust containing some amount of soil or earthen material. As indicated in Table 14, radium-226 was not detected, but uranium and thorium isotopes were detected in each bulk dust sample. The three highest activities reported—a thorium-232 activity of 9.9 pCi/g, a thorium-228 activity of 9.8 pCi/g, and a thorium-230 activity of 1.8 pCi/g—each was detected in sample BDS[redacted]BD01 collected from the unfished basement of House 2. All other detected isotope concentrations ranged from non-detect to 0.4 pCi/g. Thus, among the three bulk dust samples, the thorium isotope concentrations of sample BDS-[redacted]-BD01 appear to be unique, possibly indicating presence in the sample of a thorium-laden material unique to the sample. Such material could have derived from chemically separated thorium used in commercial products. Properties and occurrence of chemically separated thorium are discussed below.

In nature, almost all (greater than 99 percent) of thorium by mass is thorium-232, and (along with its daughter thorium-228, present with thorium-232 in equal amounts by activity) this is the isotope associated with thorium ore minerals. Thorium-230 also occurs in nature as the daughter of uranium-238 and is associated with uranium ore. Most thorium used commercially has been extracted from the mineral monazite (Hedrick 1991, as cited in NRC 2001), which variably contains some uranium, and thus some thorium-230. Monazite typically contains an activity of thorium-230 equal to 11% of the activity of thorium-232 (Albert, 1966, as cited in NRC 2001). Thus, a similar ratio of thorium-230 to thorium-232 can also be expected in chemically separated thorium used in consumer products. Examples of thorium containing products include incandescent gas mantles (e.g., mantles used in camping lanterns), welding rods, thoriated optical lenses, and various tungsten- or magnesium-thorium alloy parts or products (NRC 2001).

Examination of thorium activities in bulk dust sample BDS[redacted]-BD01 revealed virtually equal thorium-232 and thorium-228 activities, the expected secular equilibrium between parent isotope thorium-232 and its daughter thorium-228. Moreover, as indicated in Table 15, the activity ratio of thorium-230 to thorium-232 was 0.18 ± 0.05 (or 18% ± 5%)—near the literature value of 11% thorium-230 to thorium-232. Thus, thorium isotope concentrations in bulk dust sample BDS[redacted]BD01 appear to resemble those of chemically separated thorium found in consumer products.

TABLE 14

BULK DUST SAMPLES
BRIDGETON DUST SITE, BRIDGETON, MISSOURI

House	Sample	Description	Uranium Series				Thorium Series		Actinium Series
			U-238	U-234	Th-230	Ra-226	Th-232	Th-228	U-235
House 1	BDS-[redacted]-BD01	Utility Room	0.248 J	0.267 J	0.27	< 0.094	0.182	0.281	0.042
	BDS-[redacted]-BD02	Garage	0.231 J	0.366 J	0.21	< 0.126	0.214	0.26	< 0.038
	BDS[redacted]-FB	Field blank	0.054	0.155 J	< 0.3	< 0.141	< 0.074	< 0.177	< 0.058
House 2	BDS[redacted]-BD01	Basement (unfinished)	0.127	0.147 J	1.8	< 0.128	9.9	9.8	0.017
	BDS-[redacted]-FB	Field blank	< 0.052	0.085	< 0.28	< 0.121	< 0.077	< 0.19	< 0.077

Notes:

All results in picoCuries per gram.

< Radionuclide not detected (minimum detectable concentration is shown)
J Laboratory flag indicating concentration is estimated
Ra Radium
Th Thorium
U Uranium